Readmission Rates and Determinants in a Higher-Risk In-patient GIM Population

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Summary

Unplanned readmission to hospital is a costly and frequent event. The authors sought to study readmission rates and determinants in a higher-risk in-patient general internal medicine population. They undertook a medical record review of discharges from such a unit. The chart review data were then linked to administrative discharge data and used to query for any readmission within 3 months or 1 year.

The authors found that 219 in-patients were discharged alive. Of these, 51 (23.3%) were readmitted to a hospital within 3 months of discharge. In extended Kaplan-Meier analysis, there was a 47.6% readmission rate by 12 months after discharge. Important variables predicting readmission were liver disease, metastatic cancer, and a change in most responsible physician. The latter was a risk factor independent of length of hospital stay.

The authors demonstrate that patients admitted to a general internal medicine service are at high risk for readmission to hospital. A change in the most responsible physician during the index admission is an independent risk factor for readmission. Processes around the transfer of care of patients between physicians may provide an opportunity for improvement in readmission rates and overall quality of care.

Résumé

La réadmission imprévue à l'hôpital est coûteuse et fréquente. Les auteurs étudient la fréquence et les déterminants de la réadmission de patients à risque élevé hospitalisés à une unité de médecine interne générale. Ils procèdent à l'examen du dossier médical des patients ayant obtenu leur congé de cette unité de soins. Les résultats de cet examen sont combinés aux données administratives sur les congés pour former la base de données interrogée pour connaître les réadmissions dans les trois mois et dans l'année.

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Les résultats illustrent que, sur les 219 patients vivants ayant quitté l'unité de soins, 51 (23,3 %) ont été hospitalisés à nouveau dans les trois mois du congé. L'analyse selon la méthode d'estimation Kaplan-Meier démontre que le taux de réadmission dans les 12 mois du congé est de 47,6 %. Les variables majeures qui déterminent la réadmission sont l'hépatopathie, le cancer métastatique et le changement de médecin traitant. Ce dernier élément constitue un facteur de risque indépendant de la durée du séjour hospitalier.

Les auteurs constatent que les personnes hospitalisées à une unité de médecine interne générale présentent un risque élevé de réadmission. Le changement de médecin traitant responsable des soins durant l'hospitalisation initiale est un facteur de risque indépendant de réadmission. Revoir le processus de transfert des soins d'un médecin à un autre pourrait se traduire par une baisse du taux de réadmission et une amélioration de la qualité des soins en général.

Unplanned readmission to hospital is a costly and frequent event. Several studies report on hospital readmission rates, and the results vary from less than 10%¹ to almost 20%² readmission rates within 30 days of hospital discharge. Determinants of readmission have been studied and reported on for various populations and settings. In a recent notable Canadian study, van Walraven identified predictors of readmission (LACE) and these included length of stay ("L"); acuity of the admission ("A"); co-morbidity of the patient (measured with the Charlson co-morbidity index score; "C"); and emergency department use (measured as the number of visits in the 6 months before admission; "E"). That work was done on an unselected hospital population.¹ Given that many clinicians work in higher-risk in-patient medical settings, there is interest in characterizing predictors in a higher-risk population. Thus, in this study we sought to study readmission rates and determinants in a higher-risk in-patient general internal medicine population.

Methods

Study Setting and Data Collection

We undertook a medical record review of discharges, between January 1, 2005, and August 31, 2005, from an in-patient general internal medicine unit in a tertiary care centre at Foothills Medical Centre in Calgary, Alberta to determine (1) the likelihood of readmission to hospital within 3 months and extending to 1 year, and (2) the clinical profile of patients readmitted versus those not readmitted. The Medical Teaching Unit (MTU) is a team-based care environment consisting of a lead internist, a senior resident, junior residents, and medical

students. The team is supported by allied health professionals and a nursing team. A nursing team member is dedicated to discharge planning. Clinical variables extracted from medical records included cognitive impairment, home care, change in most responsible physician, changes to medication, living situation, and discharge location.

Data Linkage

The chart review data were then linked to administrative discharge data by personal health identifier. Those who died before discharge were excluded from the analysis. Discharge data from the index stay was queried for any readmission within 3 months or 1 year. Co-morbidities on the index stay were determined using ICD-10 codes and the method described by Elixhauser and colleagues (using ICD-10 coding algorithms developed by Quan et al.³).

Data Analysis

The primary analysis focused on a comparison of patients who were readmitted to hospital within 3 months versus those who were not. Chi-square tests were used to compare the frequency of co-morbidity and chart review variables in those who were readmitted versus those without readmission. A simple single-group Kaplan-Meier analysis was performed to graphically present time to readmission in all discharged patients. Logistic regression analysis was performed to assess clinical predictors of any readmission within 3 months. All variables listed in Table 1 were included in a backward step-wise regression. This method was used for variable selection, with variables retained in the model if $p < .10$. Model coefficients and odds ratios are presented.

Table 1. Clinical Variables Assessed in Patients with and without Readmission to Hospital within 3 Months of Hospital Discharge

Variables	Readmission to Any Hospital within 3 Mo (n = 51)	No Readmission within 3 Mo (n = 168)	p Value
Mean age (SD)	62.3 (17.5)	57.0 (17.9)	.067*
Male	26 (51.0%)	100 (59.5%)	.280
Elixhauser Co-morbidities			
CHF	9 (17.7%)	25 (14.9%)	.633
Arrhythmia	7 (13.7%)	21 (12.5%)	.818
Vascular disease	1 (2.0%)	6 (3.6%)	1.000 [†]
Pulmonary circulation disorders	2 (3.9%)	7 (4.2%)	1.000 [†]
Peripheral vascular disorders	3 (5.9%)	2 (1.2%)	.084 [†]
Hypertension uncomplicated	7 (13.7%)	26 (15.5%)	.760
Hypertension complicated	5 (9.8%)	8 (4.8%)	.187 [†]
Paralysis	1 (2.0%)	1 (0.6%)	.412 [†]
Other neurological disorders	1 (2.0%)	15 (8.9%)	.127 [†]
Chronic pulmonary disease	5 (9.8%)	16 (9.5%)	1.000 [†]
Diabetes uncomplicated	4 (7.8%)	25 (14.9%)	.243 [†]
Diabetes complicated	6 (11.8%)	13 (7.7%)	.397 [†]
Hypothyroidism	0	2 (1.2%)	1.000 [†]
Renal failure	6 (11.8%)	15 (8.9%)	.589 [†]
Liver disease	13 (25.5%)	22 (13.1%)	.034
Peptic ulcer disease excluding bleeding	0	4 (2.4%)	.575 [†]
HIV/AIDS	2 (3.9%)	2 (1.2%)	.232 [†]
Lymphoma	1 (2.0%)	2 (1.2%)	.551 [†]
Metastatic cancer	5 (9.8%)	4 (2.4%)	.034 [†]
Solid tumour without metastasis	5 (9.8%)	6 (3.6%)	.134 [†]
Rheumatoid arthritis/collagen	1 (2.0%)	10 (6.0%)	.464 [†]
Coagulopathy	5 (9.8%)	18 (10.7%)	.853
Obesity	0	1 (0.6%)	1.000 [†]
Weight loss	1 (2.0%)	6 (3.6%)	1.000 [†]
Fluid and electrolyte disorders	12 (23.5%)	39 (23.2%)	.963
Blood loss anemia	2 (3.9%)	4 (2.4%)	.625 [†]
Deficiency anemia	3 (5.9%)	10 (6.0%)	1.000 [†]
Alcohol abuse	6 (11.8%)	29 (17.3%)	.348
Drug abuse	4 (7.8%)	13 (7.7%)	1.000 [†]
Psychoses	0	3 (1.8%)	1.000 [†]
Depression	0	5 (3.0%)	.593 [†]

Variables	Readmission to Any Hospital within 3 Mo (n = 51)	No Readmission within 3 Mo (n = 168)	p Value
Elixhauser Count			
None	3 (5.9%)	23 (13.7%)	
One	19 (37.3%)	37 (22.0%)	
Two	11 (21.6%)	39 (23.2%)	
Three	4 (7.8%)	44 (26.2%)	
Four or more	14 (27.5%)	25 (14.9%)	
Other Factors			
Any cognitive impairment	19 (37.3%)	48 (28.6%)	.239
Home care after discharge	17 (33.3%)	36 (21.4%)	.082
New family doctor needed	4 (7.8%)	18 (10.7%)	.550
Change in most responsible physician	37 (72.6%)	96 (57.1%)	.049
Any medication changes /additions etc.	47 (92.2%)	149 (88.7%)	.479
Mean number of meds at discharge (SD)	7.0 (4.5)	5.9 (4.5)	.130
Living Situation			
Independent home/apartment	28 (54.9%)	92 (54.8%)	.986
Spouse/family member	31 (60.8%)	87 (51.8%)	.259
Lodge	1 (2.0%)	5 (3.0%)	1.000 [†]
Homeless	1 (2.0%)	9 (5.4%)	.459 [†]
Assisted	2 (3.9%)	5 (3.0%)	.666 [†]
Nursing home	4 (7.8%)	4 (2.4%)	.088 [†]
Can't tell	0	4 (2.4%)	.575 [†]
Discharge to			
Home	39 (76.5%)	138 (82.1%)	.368
Other acute care facility	5 (9.8%)	13 (7.7%)	.575 [†]
Rehab facility/transition	2 (3.9%)	10 (6.0%)	.737 [†]
Long-term care facility	5 (9.8%)	8 (4.8%)	.187 [†]

CHF = congestive heart failure; HIV/AIDS = human immunodeficiency virus/acquired immunodeficiency syndrome; SD = standard deviation.

*Denotes *F*-test used.

[†]Chi-square test used except where this symbol (†) is present. Fisher's exact test was used for these cases.

Figure 1. 1-year Kaplan-Meier (KM) plot of time to event after discharge.

Table 2. Logistic Regression Model* Predicting Any Readmission within 3 Months

Variable	β	Odds Ratio	95% CI
Intercept	-2.0485		
Liver disease	1.0342	2.813	1.26–6.29
Metastatic cancer	1.9035	6.709	1.63–27.70
Change in most responsible physician	0.8544	2.350	1.14–4.85

CI = confidence interval.

*Model Fit Statistics $-2 \log L = 222.2$, c-statistic = 0.650.

Results

Study Population

A total of 242 patient charts were reviewed for patients discharged from the MTU between January 1, 2005, and August 31, 2005. Of these, 236 were successfully linked to the administrative discharge data for the corresponding hospital stay. Among these, 27 patients died before discharge and were thus not included in our study of readmission.

Readmission Rate

Of the 219 patients discharged alive, 51 (23.3%) were readmitted to a hospital within 3 months of discharge. In our Kaplan-Meier analysis extending to 1 year, there was a 47.6% readmission rate by 12 months after discharge (Figure 1).

Clinical Profile of Readmitted Patients

Patient characteristics by readmission status are shown in Table 1. Patients who were readmitted were more likely to have liver disease (25.5% versus 13.1%), metastatic cancer (9.8% versus 2.4%), and a change in most responsible physician (72.6% versus 57.1%) than those who were not readmitted. Logistic regression with backward elimination considering all candidate

variables in Table 1 was performed keeping only variables with $p < .05$. The resulting model is presented in Table 2. Important variables predicting readmission were liver disease (odds ratio 2.81, 95% confidence interval [CI] 1.26–6.29), metastatic cancer (odds ratio 6.71, 95% CI 1.63–27.7), and change in most responsible physician (odds ratio 2.35, 95% CI 1.14–4.85). The change in most responsible physician was a risk factor independent of length of hospital stay.

Discussion

This single-centre study of readmissions yields some notable findings. First, we found a very high readmission rate in our high-risk population, both at 30 days and extending to 1 year. Second, we have identified intriguing determinants of readmission. The two clinical characteristics of liver disease and metastatic cancer are entirely plausible, and while not likely modifiable, they are important markers of readmission risk when a patient is discharged with these factors. The finding that a change in most responsible physician is also a predictor of readmission is intriguing because it points to the potential role of suboptimal transfers of care in increasing risk of readmission – a potentially modifiable risk factor.

Previous studies report readmission rates varying from 8.0% in the study published by Van Walraven et al.¹ to a rate for Medicare beneficiaries in the United States of 20%.^{2,4} The readmission rate of 23.3% in our population exceeds these. Patient related predictors of readmission have previously been reported on, with the most frequent being congestive heart failure, pneumonia, psychosis, and chronic lung disease, in a large study reported by Jencks et al.² Lee et al.⁵ found neoplasms to be of predictive importance to readmission. In our study, liver disease and metastatic cancer were significant. Others have identified transition of care from hospital to community as a period of risk, and inadequate community care and resources as risks for readmission. We also identified a system-related factor in our study, that being a change in most responsible physician. This latter finding identifies a potential area for targeted intervention focusing on handover processes.

Our study has limitations. First, it is from a single centre and has limited numbers of patients. However, our centre is a typical urban tertiary care hospital, and in such centres, it is quite common for higher-risk medical in-patients to be cared for on units such as our MTU with academic general internal medicine staff coverage. Furthermore, despite modest patient

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numbers and associated statistical power, our numbers were nonetheless sufficient to permit the demonstration of a high readmission rate in this population, as well as identification of some notable predictors for readmission that provide insight into potential areas for intervention. We found potential associations that while statistically insignificant, may nevertheless be clinically plausible and important and thus worthy of further study. Lastly, we emphasize that our focus was on predictors of readmission that are assessable prior to discharge. There are also community-based factors (e.g., availability of follow-up clinics, home support, etc.) that could influence readmission. These were not assessed in our study. There were also some pre-discharge factors, such as pre-discharge functional status, that we could not readily assess from our data sources.

In summary, we demonstrate that patients admitted to a general internal medicine service are at high risk for

readmission to hospital. A change in the most responsible physician during the index admission is an independent risk factor for readmission. Processes around the transfer of care of patients between physicians may provide an opportunity for improvement in readmission rates and the overall quality of care.

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